METHOD AND APPARATUS FOR PROVIDING A SHORT-STEMMED HIP PROSTHESIS

FIELD OF THE INVENTION

[0001] This invention relates generally to a method and apparatus for use in orthopedic surgery and, more particularly, to a method and apparatus for providing a short-stemmed hip prosthesis having a substantially constant radius over at least a portion thereof to ease insertion into bone, a raised lateral lip to resist rotation, and a biplanar taper to conserve bone tissue and promote gradual stress transfer.

BACKGROUND OF THE INVENTION

[0002] A natural hip joint may undergo degenerative changes due to a variety of etiologies. When these degenerative changes become so far advanced and irreversible, it may ultimately become necessary to replace a natural hip joint with a prosthetic hip. When implantation of such a hip joint prosthesis becomes necessary, the head of the natural femur is first resected and a cavity is created (e.g., by reaming and/or broaching) within the intermedullary canal of the host femur for accepting the hip prosthesis, typically referred to as a femoral insert. The femoral insert may be inserted and supported within the host femur by cementing the femoral insert within the host femur. Alternatively, the femoral insert may be impacted into the host femur so that it is snugly fit and supported by the host femur.

[0003] Due to any number of reasons, however, a small portion of patients that undergo such orthopedic surgical procedures may require subsequent revision surgery to replace the hip prosthesis with a new prosthetic device generally referred to as a revision prosthesis. Because conventional hip replacement procedures typically removes a relatively significant amount of bone tissue from the area surrounding the proximal intermedullary canal, there is less bone and are significant problems associated with securing the revision prosthesis to the remaining femoral structure.

[0004] In an effort to overcome this problem, the use of short-stemmed femoral inserts is being described here. By shortening the length of the stem of the femoral insert and placing the prosthesis more proximal to standard primary femoral inserts, the need to remove surrounding bone tissue from the resected femur head, femoral neck, and the intermedullary canal is substantially lessened. As a result, significant amounts of bone tissue are available for any subsequent revision procedures and therefore the ability to insert a traditional primary prosthesis as a revision to the short-stemmed femoral insert. This is especially beneficial for younger patients that will most likely require one or more revision prostheses during their lifetime.

[0005] Although these short-stemmed femoral inserts have aided somewhat in the preservation of femoral bone tissue, the issues of ease of insertion,

prosthesis rotation, loosening, stress shielding, subsidence, and loading remain to be more fully and satisfactorily addressed.

[0006] Therefore, there remains a need for a method and apparatus for providing a short-stemmed femoral insert that is easily inserted into the femur, prevents prosthesis rotation, eliminates or lessons the probability of wear debris migration distally, eliminates or at least lessens the probability of stress shielding and subsidence, and provides surface loading as opposed to point loading.

SUMMARY OF THE INVENTION

[0007] In accordance with a first embodiment of the present invention, a femoral insert for implantation into an intermedullary canal of a femur is provided, comprising a member having a lateral surface and a spaced and opposed medial surface. The lateral surface of the member has a first radius and the medial surface of the member has a second radius. The lateral surface is adapted to engage at least a portion of a lateral surface of the intermedullary canal and the medial surface is adapted to engage at least a portion of a medial surface of the metaphysis of the femur. The first radius of the lateral surface of the member is equal to or substantially equal to the second radius of the medial surface of the member.

[0008] In accordance with a second embodiment of the present invention, a femoral insert for implantation into an intermedullary canal of a femur is provided,

comprising a member having a proximal portion and a distal portion. The member has a lateral surface and a spaced and opposed medial surface extending along the proximal and distal portions. The lateral surface of the member has a first radius and the medial surface of the member has a second radius. The lateral surface is adapted to engage at least a portion of a lateral surface of the intermedullary canal and the medial surface is adapted to engage at least a portion of a medial surface of the intermedullary canal. The first radius of the lateral surface of the member is equal to or substantially equal to the second radius of the medial surface of the member. The radii of the lateral surface and the medial surface substantially converge along the distal portion so as to form a substantially arcuate configuration tangential to the proximal portion.

[0009] In accordance with a third embodiment of the present invention, a femoral insert for implantation into an intermedullary canal of a femur is provided, comprising a member having a proximal portion and a distal portion. The member has a lateral surface and a spaced and opposed medial surface extending along the proximal and distal portions. The lateral surface of the member has a first radius and the medial surface of the member has a second radius. The lateral surface is adapted to engage at least a portion of a lateral surface of the intermedullary canal and the medial surface is adapted to engage at least a portion of a medial surface of the intermedullary canal. The first radius of the lateral surface of the member is equal to or substantially equal to the second radius of the medial surface of the member. The radii of the lateral surface

and the medial surface substantially converge along the distal portion so as to form a substantially arcuate configuration that is tangential to the proximal portion. Bilateral raised members adjacent to and contiguous with at least a portion of the lateral surface of the proximal portion. The radii of the bilateral raised members decrease as the bilateral raised members extend from the proximal portion towards the distal portion.

[0010] In accordance with a fourth embodiment of the present invention, a method of implanting a femoral insert into an intermedullary canal of a femur is provided, comprising: (1) resecting the femur head, (2) removing a sufficient amount of bone tissue adjacent to the intermedullary canal such that at least a portion of the femoral insert is capable of being received into the intermedullary canal, and (3) placing at least a portion of the femoral insert into the intermedullary canal. The femoral insert comprises a member having a lateral surface and a spaced and opposed medial surface. The lateral surface of the member has a first radius and the medial surface of the member has a second radius. The lateral surface is adapted to engage at least a portion of a lateral surface of the intermedullary canal and the medial surface is adapted to engage at least a portion of a medial surface of the intermedullary canal. The first radius of the lateral surface of the member is equal to or substantially equal to the second radius of the medial surface of the member.

[0011] A more complete appreciation of the present invention and its scope

can be obtained from the following detailed description of the invention, the drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0013] Figure 1 is an front elevational view of a femoral insert, in accordance with one embodiment of the present invention;

[0014] Figure 1A is an side elevational view of the femoral insert depicted in Figure 1, in accordance with one embodiment of the present invention;

[0015] Figure 2 is a top plan view of the femoral insert depicted in Figure 1, in accordance with one embodiment of the present invention;

[0016] Figure 3 is a cross-sectional view along line 3-3 of the femoral insert depicted in Figure 1, in accordance with one embodiment of the present invention;

[0017] Figure 4 is a cross-sectional view along line 4-4 of the femoral insert depicted in Figure 1, in accordance with one embodiment of the present invention;

[0018] Figure 5 is a cross-sectional view along line 5-5 of the femoral insert depicted in Figure 1, in accordance with one embodiment of the present invention;

[0019] Figure 6 is a partial cross-sectional view of the femoral insert

depicted in Figure 1 that has been implanted into an intermedullary canal of a femur, in accordance with one embodiment of the present invention;

[0020] Figure 7 is a cross-sectional view along line 7-7 of the femoral insert depicted in Figure 6, in accordance with one embodiment of the present invention;

[0021] Figure 8 is a cross-sectional view along line 8-8 of the femoral insert depicted in Figure 6, in accordance with one embodiment of the present invention;

[0022] Figure 9 is a cross-sectional view along line 9-9 of the femoral insert depicted in Figure 6, in accordance with one embodiment of the present invention;

[0023] Figure 10 is an front elevational view of an alternative femoral insert, in accordance with an alternative embodiment of the present invention;

[0024] Figure 10A is an side elevational view of the femoral insert depicted in Figure 10, in accordance with an alternative embodiment of the present invention;

[0025] Figure 11 is a cross-sectional view along line 11-11 of the femoral insert depicted in Figure 10, in accordance with an alternative embodiment of the present invention;

[0026] Figure 12 is a top plan view of the femoral insert depicted in Figure 10, in accordance with an alternative embodiment of the present invention;

[0027] Figure 13 is a cross-sectional view along line 13-13 of the femoral insert depicted in Figure 10, in accordance with an alternative embodiment of the present

invention;

[0028] Figure 14 is a bottom plan view of the femoral insert depicted in Figure 10, in accordance with an alternative embodiment of the present invention;

[0029] Figure 15 is a cross-sectional view along line 15-15 of the femoral insert depicted in Figure 10, in accordance with an alternative embodiment of the present invention;

[0030] Figure 16 is a partial cross-sectional view of the femoral insert depicted in Figure 10 that has been implanted into an intermedullary canal of a femur, in accordance with an alternative embodiment of the present invention;

[0031] Figure 17 is a cross-sectional view along line 17-17 of the femoral insert depicted in Figure 16, in accordance with an alternative embodiment of the present invention;

[0032] Figure 17A is a cross-sectional view along line 17A-17A of the femoral insert depicted in Figure 16, in accordance with an alternative embodiment of the present invention;

[0033] Figure 17B is a cross-sectional view along line 17B-17B of the femoral insert depicted in Figure 16, in accordance with an alternative embodiment of the present invention;

[0034] Figure 18 is an front elevational view of a second alternative femoral insert, in accordance with a second alternative embodiment of the present invention;

[0035] Figure 18A is an side elevational view of the femoral insert depicted in Figure 18, in accordance with a second alternative embodiment of the present invention;

[0036] Figure 19 is a cross-sectional view along line 19-19 of the femoral insert depicted in Figure 18, in accordance with a second alternative embodiment of the present invention;

[0037] Figure 20 is a top plan view of the femoral insert depicted in Figure 18, in accordance with a second alternative embodiment of the present invention;

[0038] Figure 21 is a cross-sectional view along line 21-21 of the femoral insert depicted in Figure 18, in accordance with a second alternative embodiment of the present invention;

[0039] Figure 22 is a bottom plan view of the femoral insert depicted in Figure 18, in accordance with a second alternative embodiment of the present invention;

[0040] Figure 23 is a cross-sectional view along line 23-23 of the femoral insert depicted in Figure 18, in accordance with a second alternative embodiment of the present invention;

[0041] Figure 24 is a partial cross-sectional view of the femoral insert depicted in Figure 18 that has been implanted into an intermedullary canal of a femur, in accordance with a second alternative embodiment of the present invention;

[0042] Figure 25 is a cross-sectional view along line 25-25 of the femoral

insert depicted in Figure 24, in accordance with a second alternative embodiment of the present invention;

[0043] Figure 25A is a cross-sectional view along line 25A-25A of the femoral insert depicted in Figure 24, in accordance with a second alternative embodiment of the present invention; and

[0044] Figure 25B is a cross-sectional view along line 25B-25B of the femoral insert depicted in Figure 24, in accordance with a second alternative embodiment of the present invention.

[0045] The same reference numerals refer to the same parts throughout the various figures.

DETAILED DESCRIPTION OF THE INVENTION

[0046] The following description of the preferred embodiments concerning a method and apparatus for providing a short-stemmed femoral insert for use in orthopedic surgical procedures are merely exemplary in nature and are not intended to limit the invention or its application or uses. Moreover, while the present invention is described in detail below with reference to performing a primary type implantation procedure, it will be appreciated by those skilled in the art that the present invention is clearly not limited to only primary type orthopedic surgical procedures and may be used with various other orthopedic surgical procedures as well, including

revision type orthopedic surgical procedures.

[0047] Referring to Figures 1-5, there is generally shown a femoral insert 10, in accordance with one embodiment of the present invention. The femoral insert 10 is preferably comprised of a biocompatible material, such as titanium alloys, stainless steel, chrome-cobalt alloys, and the like. The femoral insert 10 includes a trunion portion 12 and a stem portion 14. At the distal end 16 of the trunion portion 12, the stem portion 14 includes a tapered proximal portion 18, such that a taper exists in the anterior-posterior (AP) plane. The taper begins at the proximal portion 18 and extends downwardly towards the distal end portion 20 of the stem portion 14.

[0048] The stem portion 14 is approximately 95 mm long and thus would be considered to fall into the afore-mentioned short-stemmed femoral insert category. However, stem portions having lengths in the range of about 75 mm to about 105 mm are envisioned, as well. The use of a short stem reduces the incidence of thigh pain typically associated with loading of a relatively long-stemmed femoral implant. Additionally, the short stem allows for the conservation of bone tissue in and around the femoral neck and intermedullary canal, and accordingly, the present invention can be used in primary type implantation procedures, as well as revision type implantation procedures.

[0049] The stem portion 14 is actually comprised of two distinct sections: a proximal section 14A and a distal section 14C. It is envisioned that the stem portion 14

can be defined by a single region with a varying radius. As best seen in Figures 2-5, the cross-section has a generally elliptical shape. Those skilled in the art will understand that the cross-section can also be circular or another appropriate shape.

[0050] The proximal section 14A preferably includes lateral and medial surfaces, L and M, respectively, having an equal, or at least substantially constant equal radius, i.e., as the cross-sectional area of the stem 14 decreases from the proximal portion 18 to the distal end portion 20, the radius of the lateral surface L is equal to, or at least substantially equal to, the radius of the medial surface M. The proximal section 14A preferably includes anterior and posterior surfaces, A and P, respectively, having a equal, or at least substantially equal taper angle, i.e. as the diameter of the stem 14 decreases from the proximal portion 18 to the distal portion 20. The benefit of the equal constant radius feature is that it allows for easier insertion of the femoral insert and lateral surface loading (e.g., against the lateral surface of the cortical bone of the intermedullary canal), as opposed to point loading, as is the case for conventional short-stemmed femoral inserts. The benefit of the taper feature is that it allows for ease of insertion and better off-loading of the implant to the host femur. This allows the femoral insert 10 to better tolerate and withstand the loading forces typically experienced by femoral inserts, for example, during walking, running, or jumping by the patient.

[0051] The outer surface of the proximal section 14A may be provided with an optional cicumferential porous coating (not shown) so as to facilitate the in-growth of

new bone tissue therein. The porous coating can be a variety of applications including, but not limited to titanium plasma spray, sintered beads, titanium mesh, etc. The optional porous coating can also be applied at varying levels thus not being limited to only the proximal section 14A, but also 14C.

[0052] The distal section 14C, is a section where the respective radii of the lateral surface L and medial surface M of the proximal section 14A converge together towards the distal end portion 20. However, instead of converging together to form a point along the longitudinal axis of the stem portion 14, the respective radii converge so as to form a distal arc taper portion 14C. The benefit of the distal arc taper section 14C is that it prevents subsidence of the femoral insert 10 and prevents point loading of the distal end of the femoral insert.

[0053] The implantation of the femoral insert 10 will now be described in connection with a primary type implantation procedure. However, as previously mentioned, the femoral insert 10 is equally useful for revision type implantation procedures, as well.

[0054] Referring to Figures 6-9, the femoral implant 10 is shown in its fully and properly seated position within the intermedullary canal 60 of a patient's femur 62. The femur head 64, shown in dashed line, has been previously resected and the proximal portion 66 of the intermedullary canal 60 has been properly broached and prepared for the femoral insert 10. It should be noted that there is generally no need for

reaming with the femoral insert 10 of the present invention.

[0055] The femoral insert 10 is very easily inserted into the intermedullary canal 60 and may then be pressed further into the intermedullary canal 60 so as to be snuggly and securely retained therein, as is known in the art. There is generally no need for bone cement; however, bone cement may be used, if clinically indicated.

[0056] It will be noted that the medial surface M of the proximal portion 14A abuts against the medial surface of the proximal portion 66 of the intermedullary canal (femoral neck) 60, i.e., against the cortical bone tissue. It will also be noted that the lateral surface L of the mid portion (slightly distal to Figure 8) abuts against the lateral surface of the intermedullary canal, i.e., against the cortical bone tissue. Thus, the loading of the femoral insert 10 is surface loading as opposed to point loading. This feature greatly enhances the ability of the femoral insert 10 to withstand the significant stresses and loads placed upon it by the patient's various movements. Further, the loading characteristics of the femoral insert 10 also aids in the prevention and/or lessening of stress shielding and thigh pain. Additionally, it will be noted that other areas of surface loading are available as well, such as, but not limited to the femoral neck and calcar region, as well as the femoral head and acetabulum region.

[0057] It will also be noted that the distal arc taper section 14C extends towards the medial surface of the medial surface of the intermedullary canal 60, and thus prevents subsidence of the femoral insert 10. In addition, this allows for variations in

placement of the femoral insert without the incidence of point loading.

[0058] Another feature of the femoral insert 10 is that the proximal portion 18 is placed above the typical resection level R of typical primary and other short-stemmed femoral inserts. This allows less bone to be removed and greater fixation of the femoral insert in the femoral neck thereby leaving more bone if a revision operation is required at some point. This also allows for a smaller incision to be utilized for a more bone conservative treatment of the disease.

[0059] In accordance with an alternative embodiment of the present invention, a bilateral radial lip is provided on the entire lateral surface of the stem portion of the femoral insert. Without being bound to a particular theory of the operation of the present invention, it is believed that the bilateral radial lip prevents the unintended rotation of the femoral insert upon implantation within the intermedullary canal and throughout loading of the femoral insert after implantation.

[0060] Referring to Figures 10-15, there is generally shown an alternative femoral insert 100, in accordance with an alternative embodiment of the present invention. The femoral insert 100 is also comprised of a biocompatible material, such as titanium alloys, stainless steel, chrome-cobalt alloys, and the like. As with the previously described embodiment, the femoral insert 100 includes a trunion portion 102 and a stem portion 104. At the distal end 106 of the trunion portion 102, the stem portion 104 includes a tapered proximal portion 108, such that a taper exists in the anterior-posterior

(AP) plane. The taper begins at the proximal portion 108 and extends downwardly towards the distal end portion 120 of the stem portion 104. Again, there is the feature of a constant equal or substantially equivalent radius between the lateral surface L and the medial surface M of the femoral insert 100. While the stem portion 104 is shown comprised of three distinct sections: a proximal section 104A, an intermediate transition section 104B, and a distal section 104C. It is envisioned that the stem portion 104 can be formed of a single distal converging arc taper from the distal end 106 of the trunion portion 102 to the distal end portion 120. Again, the outer surface of the proximal section 104A may be provided with an optional porous coating (not shown) so as to facilitate the in-growth of new bone tissue therein.

[0061] However, the primary difference between the alternative embodiment and the embodiment depicted in Figures 1-9 is the presence of a bilateral lip member 122 extending along the lateral surface L of the proximal section 104A of the stem 104. The bilateral lip member 122 preferably gradually diminishes in diameter as it approaches the end of the distal converging arc taper section 104C. The actual radius of the lateral surface remains constant from the proximal section 104A to the intermediate transition section 104B. Distal to the transition section the radius of lateral surface decreases allowing the lip to gradually blend into the distal section 104C ending at 120.

[0062] The stem portion 104 is approximately 95 mm long and thus would

be considered to fall into the afore-mentioned short-stemmed femoral insert category. However, stem portions in the range of about 75 mm to about 105 mm are envisioned, as well.

[0063] The implantation of the femoral insert 100 will now be described in connection with a primary type implantation procedure. However, as previously mentioned, the femoral insert 100 is equally useful for revision type implantation procedures, as well.

[0064] Referring to Figures 16-17B, the femoral implant 100 is shown in its fully and properly seated position within the intermedullary canal 60 of a patient's femur 62. The femur head 64, shown in dashed line, has been previously resected and the proximal portion 66 of the intermedullary canal 60 has been properly broached and prepared for the femoral insert 100. It should be noted that there is generally no need for reaming with the femoral insert 100 of the present invention and that there is no need to enter a preparation device into the femoral canal (diaphyseal) region according to standard primary femoral insert surgical technique.

[0065] The femoral insert 100 is very easily inserted into the intermedullary canal 60 and may then be pressed further into the intermedullary canal 60 so as to be snuggly and securely retained therein, as is known in the art. There is generally no need for bone cement; however, bone cement may be used, if clinically indicated.

[0066] It will be noted that the lateral bilateral lip members 122 of the

proximal portion 104A abuts against the lateral surface of the proximal portion 66 of the intermedullary canal 60, i.e., against the cortical bone tissue. Thus, providing rotational stability of the implant during loading of the femoral insert 100. In addition, it will be noted that the medial surface M of the proximal portion 104A abuts against the medial surface of the proximal portion 66 of the intermedullary canal (femoral neck), i.e., against the cortical bone tissue. It will also be noted that the lateral surface L of the mid portion (slightly distal to Figure 17A) abuts against the lateral surface of the intermedullary canal, i.e., against the cortical bone tissue. This feature greatly enhances the ability of the femoral insert 100 to withstand the significant stresses and loads placed upon it by the patient's various movements. Further, the loading characteristics of the femoral insert 100 also aids in the prevention and/or lessening of stress shielding and thigh pain. Additionally, it will be noted that other areas of surface loading are available as well, such as, but not limited to the femoral neck and calcar region, as well as the femoral head and acetabulum region.

[0067] It will also be noted that the distal arc taper section 104C extends towards the medial surface of the medial surface of the intermedullary canal 60, and thus prevents subsidence of the femoral insert 100 and allows variations in stem placement without undergoing point loading.

[0068] In accordance with another alternative embodiment of the present invention, a bilateral radial lip is provided on only a portion of the lateral surface of the

stem portion of the femoral insert, as opposed to the entire lateral surface. Again, without being bound to a particular theory of the operation of the present invention, it is believed that the bilateral radial lip prevents the unintended rotation of the femoral insert upon implantation within the intermedullary canal and during loading of the femoral insert once implanted.

[0069] Referring to Figures 18-23, there is generally shown a second alternative femoral insert 200, in accordance with an alternative embodiment of the present invention. The femoral insert 200 is also comprised of a biocompatible material, such as titanium alloys, stainless steel, chrome-cobalt alloys, and the like. As with the previously described alternative embodiment, the femoral insert 200 includes a trunion portion 202 and a stem portion 204. The stem portion 204 includes a curvature from the distal end 206 to distal end 220. The curvature begins at the proximal portion 208 and extends downwardly towards the distal end portion 220 of the stem portion 204 and has a constant or substantially equivalent equal radius between the lateral surface L and the medial surface M of the femoral insert 200. Additionally, the stem portion 204 is comprised of three distinct sections: a proximal section 204A, an intermediate transition section 204B, and a distal section 204C. Again, the outer surface of the proximal section 204A may be provided with an optional circumferential porous coating (not shown) or the like so as to facilitate the in-growth of new bone tissue therein.

[0070] However, the primary difference between the second alternative embodiment and the embodiment depicted in Figures 10-17B is the presence of a bilateral lip member 222 extending along only a portion of the lateral surface L of the proximal section 204A of the stem 204 and the constant curvature. The bilateral lip member 222 preferably gradually diminishes in diameter as it approaches the intermediate transition section 204B and is completely absent as it approaches the end of the distal section 104C. It is envisioned that any of the embodiments can have the constant curvature as opposed to the tapered proximal end.

[0071] The stem portion 204 is approximately 95 mm long and thus would be considered to fall into the afore-mentioned short-stemmed femoral insert category. However, stem portions in the range of about 75 mm to about 105 mm are envisioned, as well.

[0072] The implantation of the femoral insert 200 will now be described in connection with a primary type implantation procedure. However, as previously mentioned, the femoral insert 200 is equally useful for revision type implantation procedures, as well.

[0073] Referring to Figures 24-25B, the femoral implant 200 is shown in its fully and properly seated position within the intermedullary canal 60 of a patient's femur 62. The femur head 64, shown in dashed line, has been previously removed and the proximal portion 66 of the intermedullary canal 60 has been properly broached and

prepared for the femoral insert 200. It should be noted that there is generally no need for reaming with the femoral insert 200 of the present invention.

[0074] The femoral insert 200 is very easily inserted into the intermedullary canal 60 and may then be pressed further into the intermedullary canal 60 so as to be snuggly and securely retained therein, as is known in the art. There is generally no need for bone cement; however, bone cement may be used, if clinically indicated.

[0075] It will be noted that the bilateral radial lip members 222 of the proximal portion 204A abuts against the lateral surface of the proximal portion 66 of the intermedullary canal 60, i.e., against the cortical bone tissue. Thus, providing rotational stability of the implant during loading of the femoral insert 200. In addition, it will be noted that the medial surface M of the proximal portion 204A abuts against the medial surface of the proximal portion 66 of the intermedullary canal (femoral neck), i.e., against the cortical bone tissue. It will also be noted that the lateral surface L of the mid portion (slightly distal to Figure 25A) abuts against the lateral surface of the intermedullary canal, i.e., against the cortical bone tissue. This feature greatly enhances the ability of the femoral insert 200 to withstand the significant stresses and loads placed upon it by the patient's various movements. Further, the loading characteristics of the femoral insert 200 also aid in the prevention and/or lessening of stress shielding and thigh pain. Additionally, it will be noted that other areas of surface loading are available as well, such as, but not limited to the femoral neck and calcar region, as well as the femoral head and

acetabulum region.

[0076] It will also be noted that the distal section 204C extends towards the medial surface of the medial surface of the intermedullary canal 60, and thus prevents subsidence of the femoral insert 200 and allow various orientations of the femoral insert without point loading.

[0077] The foregoing description is considered illustrative only of the principles of the invention. Furthermore, because numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and process shown as described above. Accordingly, all suitable modifications and equivalents that may be resorted to that fall within the scope of the invention as defined by the claims that follow.